Using Statistics in Ratio Study Analysis

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Overview

- Mann-Whitney Test

- Spearman Rank Test

- Correlation

- Statistical Significance

Mann-Whitney Test

- Introductory Problem

- Concept

- Calculation

- Worked Example

Introductory Problem

- A taxpayer claims that properties in his neighborhood have been assessed inequitably. In particular, he alleges that sold properties were re-assessed to bring them closer to the sale price, while unsold properties were left alone. To prove his case, he calculates the percentage change in total assessed value from last year to this year for both sold and unsold properties in his neighborhood.

- How can we determine whether his allegations are legitimate?

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Introductory Problem

Sold Parcels	Unsold Parcels	
4.9%	5.0%	5.0%
4.6%	5.1%	5.3%
4.8%	5.5%	4.9%
5.0%	5.1%	4.8%
12.3%	4.7%	5.4%
13.0%	5.3%	4.5%
24.5%	4.6%	4.6%
	5.4%	5.3%
	4.6%	5.2%
	5.4%	4.8%
	5.1%	8.4%
	5.5%	9.5%
	4.8%	11.7%
	5.1%	13.6%
	4.8%	25.6%

Median (Sold): 5.0%
Median (Unsold): 5.1%

Concept

Sold Parcels	Unsold Parcels	
10.0%	0.0%	0.0%
10.0%	0.0%	0.0%
10.0%	0.0%	0.0%
10.0%	0.0%	0.0%
10.0%	0.0%	0.0%
10.0%	0.0%	0.0%
10.0%	0.0%	0.0%
	0.0%	0.0%
	0.0%	0.0%
	0.0%	0.0%
	0.0%	0.0%
	0.0%	0.0%
	0.0%	0.0%
	0.0%	0.0%
	0.0%	0.0%

Median (Sold): 10.0%
Median (Unsold): 0.0%

Concept

Sold Parcels	Unsold Parcels	
10.0%	3.0%	3.0%
10.0%	3.0%	3.0%
10.0%	3.0%	3.0%
10.0%	3.0%	3.0%
10.0%	3.0%	3.0%
10.0%	3.0%	3.0%
10.0%	3.0%	3.0%
	3.0%	3.0%
	3.0%	3.0%
	3.0%	3.0%
	3.0%	3.0%
	3.0%	3.0%
	3.0%	3.0%
	3.0%	3.0%
	3.0%	3.0%

Median (Sold): 10.0%
Median (Unsold): 3.0%

Concept

Sold Parcels	Unsold Parcels	
9.6%	2.6%	4.0%
10.1%	3.1%	3.6%
10.5%	3.5%	4.0%
10.4%	3.4%	3.4%
10.7%	3.7%	2.9%
10.4%	3.4%	2.7%
9.9%	2.9%	3.2%
	3.5%	3.8%
	3.0%	3.4%
	3.1%	3.4%
	2.8%	3.1%
	3.6%	3.3%
	2.8%	3.1%
	3.6%	3.2%
	3.8%	2.8%

Median (Sold): 10.4%
Median (Unsold): 3.4%

Calculation

- Percentage Change in assessed value for sold parcels (Sold).

- Percentage Change in assessed value for unsold parcels (Unsold).

Sold	Unsold
12%	5%
3%	1%
7%	0%
-7%	6%
4%	-2%

Calculation

- Arrange all values in a single row, from largest to smallest.

  12 7 6 5 4 3 1 0 -2 -7

Sold	Unsold
12%	5%
3%	1%
7%	0%
-7%	6%
4%	-2%

Calculation

- Place an "S" under each Sold Value

12 7 6 5 4 3 1 0 -2 -7
S   S   S S   S

Sold	Unsold
12%	5%
3%	1%
7%	0%
-7%	6%
4%	-2%

Calculation

- Place a "U" under each Unsold value.

12 7 6 5 4 3 1 0 -2 -7
S   S U U S S U U U S

Sold	Unsold
12%	5%
3%	1%
7%	0%
-7%	6%
4%	-2%

Calculation

- Count how many "U"s are to the right of each "S" (vice versa)

12   7   6   5   4   3   1   0   -2   -7

S   S   U   U   S   S   U   U   U   S

Rank S: 16

Rank U: 9

Sold	Unsold
12%	5%
3%	1%
7%	0%
-7%	6%
4%	-2%

Calculation

- Compare the value on the Mann-Whitney table with the smaller of the two ranks.

- If the rank is less than the lookup value, the sold and unsold may have been assessed differently.

Critical Values for the Mann-Whitney U-Test

Level of significance: 5% (P = 0.05)

Size of the largest sample (n_2) — Size of the smallest sample (n_1)

n_1 \ n_2	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
3	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	13	13
4	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	17	18	19	20	21	22	23
5	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20	22	23	24	25	27	28	29	30	32	33
6		5	6	8	10	11	13	14	16	17	19	21	22	24	25	27	29	30	32	33	35	37	38	40	42	43
7			8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54
8				13	15	17	19	22	24	26	29	31	34	36	38	41	43	45	48	50	53	55	57	60	62	65
9					17	20	23	26	28	31	34	37	39	42	45	48	50	53	56	59	62	64	67	70	73	76
10						23	26	29	33	36	39	42	45	48	52	55	58	61	64	67	71	74	77	80	83	87
11							30	33	37	40	44	47	51	55	58	62	65	69	73	76	80	83	87	90	94	98
12								37	41	45	49	53	57	61	65	69	73	77	81	85	89	93	97	101	105	109
13									45	50	54	59	63	67	72	76	80	85	89	94	98	102	107	111	116	120
14										55	59	64	67	74	78	83	88	93	98	102	107	112	118	122	127	131
15											64	70	75	80	85	90	96	101	106	111	117	122	125	132	138	143
16												75	81	86	92	98	103	109	115	120	126	132	138	143	149	154
17													87	93	99	105	111	117	123	129	135	141	147	154	160	166
18														99	106	112	119	125	132	138	145	151	158	164	171	177
19															113	119	126	133	140	147	154	161	168	175	182	189
20																127	134	141	149	156	163	171	178	186	193	200
21																	142	150	157	165	173	181	188	196	204	212
22																		158	166	174	182	191	199	207	215	223
23																			175	183	192	200	209	218	226	235
24																				192	201	210	219	228	238	247
25																					211	220	230	239	249	258
26																						230	240	250	260	270
27																							250	261	271	282
28																								272	282	293
29																									294	305
30																										317

The Open Door Web Site
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Size of the largest sample (n_2)

n_1	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
3	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	13	13
4	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	17	18	19	20	21	22	23
5	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20	22	23	24	25	27	28	29	30	32	33
6		5	6	8	10	11	13	14	16	17	19	21	22	24	25	27	29	30	32	33	35	37	38	40	42	43
7			8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54
8				13	15	17	19	22	24	26	29	31	34	36	38	41	43	45	48	50	53	55	57	60	62	65
9					17	20	23	26	28	31	34	37	39	42	45	48	50	53	56	59	62	64	67	70	73	76
10						23	26	29	33	36	39	42	45	48	52	55	58	61	64	67	71	74	77	80	83	87
11							30	33	37	40	44	47	51	55	58	62	65	69	73	76	80	83	87	90	94	98
12								37	41	45	49	53	57	61	65	69	73	77	81	85	89	93	97	101	105	109
13									45	50	54	59	63	67	72	76	80	85	89	94	98	102	107	111	116	120
14										55	59	64	67	74	78	83	88	93	98	102	107	112	118	122	127	131
15											64	70	75	80	85	90	96	101	106	111	117	122	125	132	138	143
16												75	81	86	92	98	103	109	115	120	126	132	138	143	149	154
17													87	93	99	105	111	117	123	129	135	141	147	154	160	166
18														99	106	112	119	125	132	138	145	151	158	164	171	177
19															113	119	126	133	140	147	154	161	168	175	182	189
20																127	134	141	149	156	163	171	178	186	193	200
21																	142	150	157	165	173	181	188	196	204	212
22																		158	166	174	182	191	199	207	215	223
23																			175	183	192	200	209	218	226	235
24																				192	201	210	219	228	238	247
25																					211	220	230	239	249	258
26																						230	240	250	260	270
27																							250	261	271	282
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Size of the smallest sample (n_1)

Worked Example

- A taxpayer claims that properties in his neighborhood have been assessed inequitably. In particular, he alleges that sold properties were re-assessed to bring them closer to the sale price, while unsold properties were left alone. To prove his case, he calculates the percentage change in total assessed value from last year to this year for both sold and unsold properties in his neighborhood.

- How can we determine whether his allegations are legitimate?
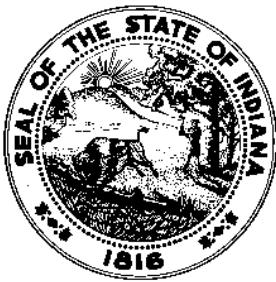
Worked Example

Sold Parcels	Unsold Parcels	
4.9%	5.0%	5.0%
4.6%	5.1%	5.3%
4.8%	5.5%	4.9%
5.0%	5.1%	4.8%
12.3%	4.7%	5.4%
13.0%	5.3%	4.5%
24.5%	4.6%	4.6%
	5.4%	5.3%
	4.6%	5.2%
	5.4%	4.8%
	5.1%	8.4%
	5.5%	9.5%
	4.8%	11.7%
	5.1%	13.6%
	4.8%	25.6%

Median (Sold): 5.0%
Median (Unsold): 5.1%

Worked Example

25.6	24.5	13.8	13.0	12.3	11.7	9.5	8.4	5.5	
5.5	5.4	5.4	5.4	5.3	5.3	5.3	5.2	5.1	
5.1	5.1	5.1	5.0	5.0	5.0	4.9	4.9	4.8	
4.8	4.8	4.8	4.8	4.7	4.6	4.6	4.6	4.6	4.5
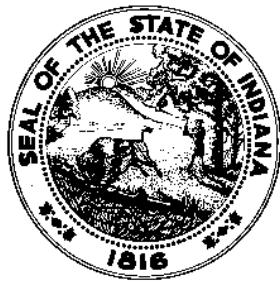
Worked Example

25.6	24.5	13.8	13.0	12.3	11.7	9.5	8.4	5.5	
U	S	U	S	S	U	U	U	U	
5.5	5.4	5.4	5.4	5.3	5.3	5.3	5.2	5.1	
U	U	U	U	U	U	U	U	U	
5.1	5.1	5.1	5.0	5.0	5.0	4.9	4.9	4.8	
U	U	U	U	U	S	U	S	U	
4.8	4.8	4.8	4.8	4.7	4.6	4.6	4.6	4.6	4.5
U	U	S	U	U	U	S	U	U	U

Worked Example

25.6	24.5	13.8	13.0	12.3	11.7	9.5	8.4	5.5
U	S	U	S	S	U	U	U	U

Rank S: 117
Rank U: 93

5.5	5.4	5.4	5.4	5.3	5.3	5.3	5.2	5.1
U	U	U	U	U	U	U	U	U

5.1	5.1	5.1	5.0	5.0	5.0	4.9	4.9	4.8
U	U	U	U	U	S	U	S	U

4.8	4.8	4.8	4.8	4.7	4.6	4.6	4.6	4.6	4.5
U	U	S	U	U	U	S	U	U	U

Size of the largest sample (n_2)

Size of the smallest sample (n_1)

n_1 \ n_2	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
3	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	13	13
4	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	17	18	19	20	21	22	23
5	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20	22	23	24	25	27	28	29	30	32	33
6		5	6	8	10	11	13	14	16	17	19	21	22	24	25	27	29	30	32	33	35	37	38	40	42	43
7			8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54
8				13	15	17	19	22	24	26	29	31	34	36	38	41	43	45	48	50	53	55	57	60	62	65
9					17	20	23	26	28	31	34	37	39	42	45	48	50	53	56	59	62	64	67	70	73	76
10						23	26	29	33	36	39	42	45	48	52	55	58	61	64	67	71	74	77	80	83	87
11							30	33	37	40	44	47	51	55	58	62	65	69	73	76	80	83	87	90	94	98
12								37	41	45	49	53	57	61	65	69	73	77	81	85	89	93	97	101	105	109
13									45	50	54	59	63	67	72	76	80	85	89	94	98	102	107	111	116	120
14										55	59	64	67	74	78	83	88	93	98	102	107	112	118	122	127	131
15											64	70	75	80	85	90	96	101	106	111	117	122	125	132	138	143
16												75	81	86	92	98	103	109	115	120	126	132	138	143	149	154
17													87	93	99	105	111	117	123	129	135	141	147	154	160	166
18														99	106	112	119	125	132	138	145	151	158	164	171	177
19															113	119	126	133	140	147	154	161	168	175	182	189
20																127	134	141	149	156	163	171	178	186	193	200
21																	142	150	157	165	173	181	188	196	204	212
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Questions?

Spearman Rank Test

- Introductory Problem

- Concept

- Calculation

- Worked Example

Introductory Problem

- You have assessed a group of six properties, and all statistics are fine except for the PRD, which is low. You have re-checked your data and believe the assessments are correct.

- How can you be sure there is no inequity?

Introductory Problem

Assessed Value	Sale Price	Ratio
35,000	56,000	0.63
34,100	33,200	1.03
91,000	86,400	1.05
119,800	129,800	0.92
136,600	101,200	1.35
174,500	145,300	1.20

Median: 1.04
COD: 16.5%
PRD: 0.96

Concept

- Vertical Inequity: When high-value properties are assessed by a different standard than low-value properties.
  - Progressivity: High-value properties over-assessed
  - Regressivity: Low-value properties over-assessed

Concept

Plot of Sale Price vs. Sales Ratio

Sale Price	Ratio
100000	0.80
110000	0.85
120000	0.90
130000	0.95
140000	1.00
150000	1.05
160000	1.10
170000	1.15
180000	1.20
190000	1.25
200000	1.30

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Concept

Plot of Sale Price vs. Sales Ratio
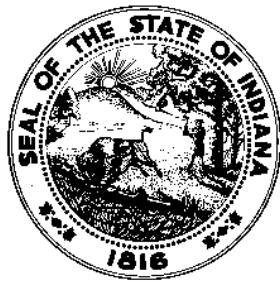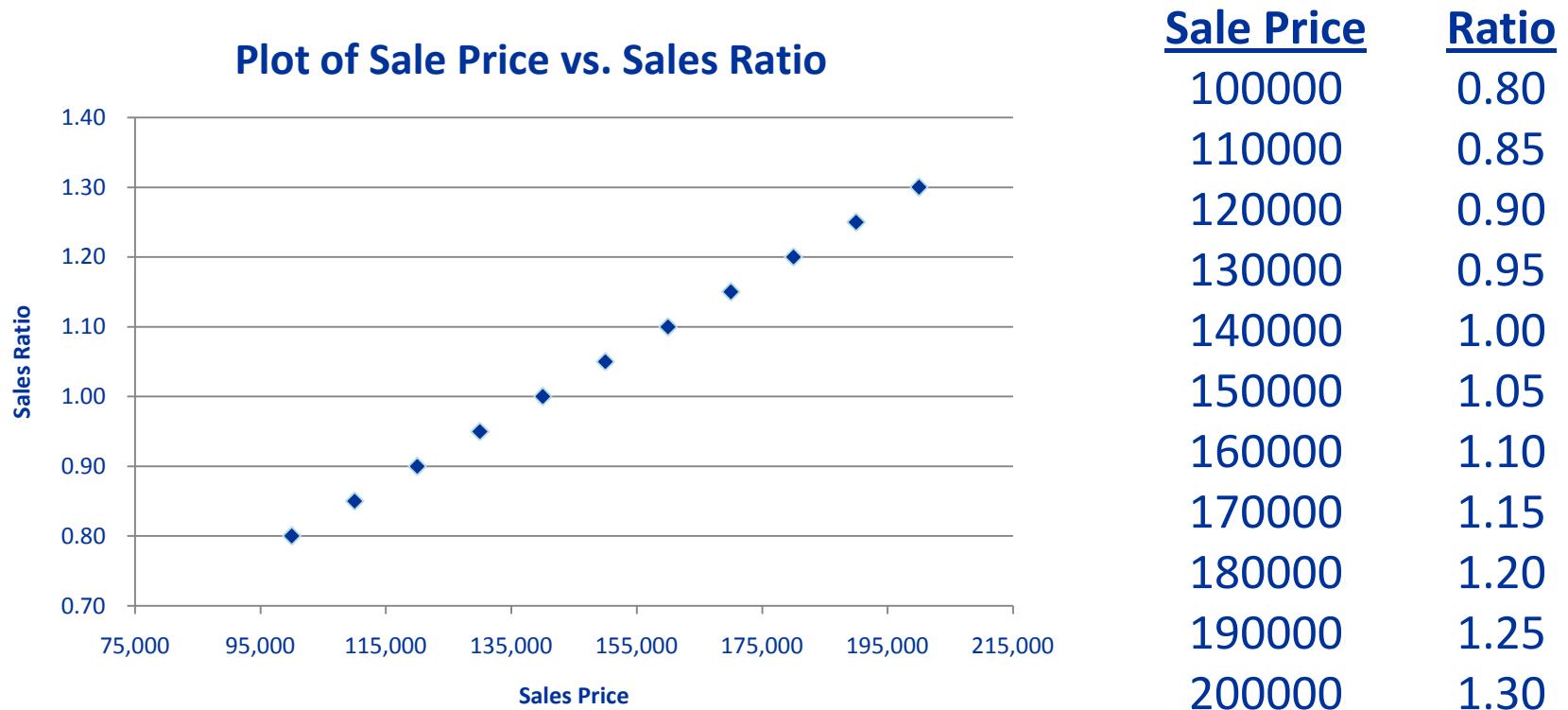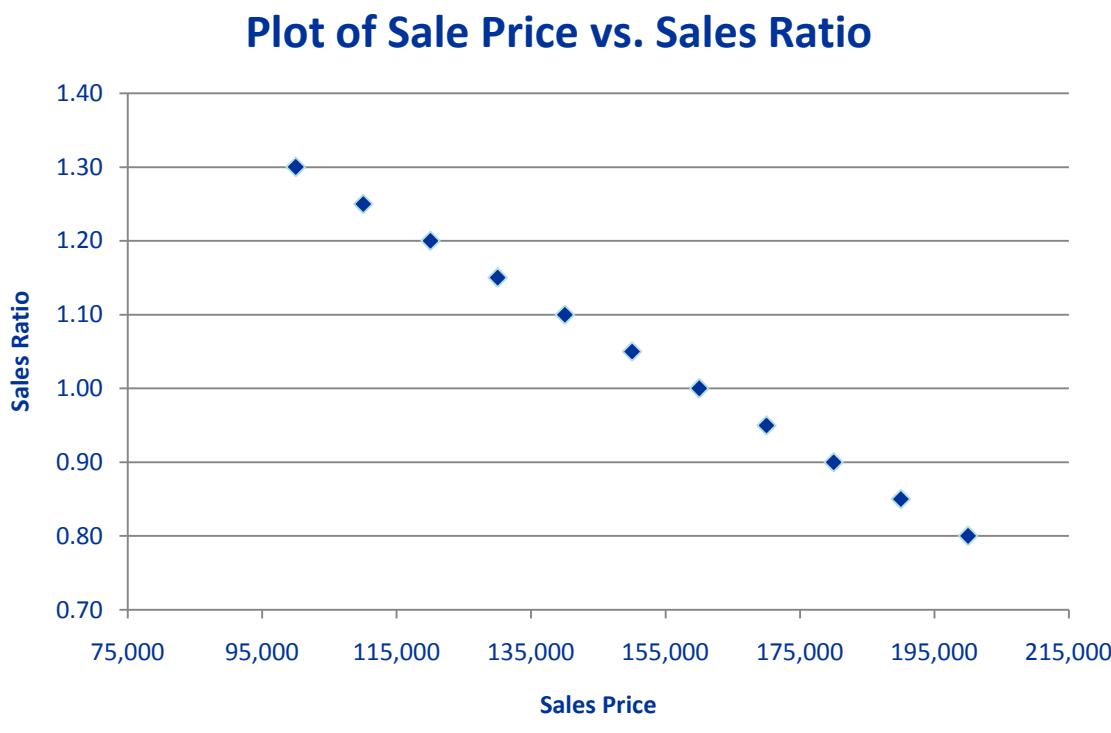
Sale Price	Ratio
100,000	1.30
110,000	1.25
120,000	1.20
130,000	1.15
140,000	1.10
150,000	1.05
160,000	1.00
170,000	0.95
180,000	0.90
190,000	0.85
200,000	0.80

Concept
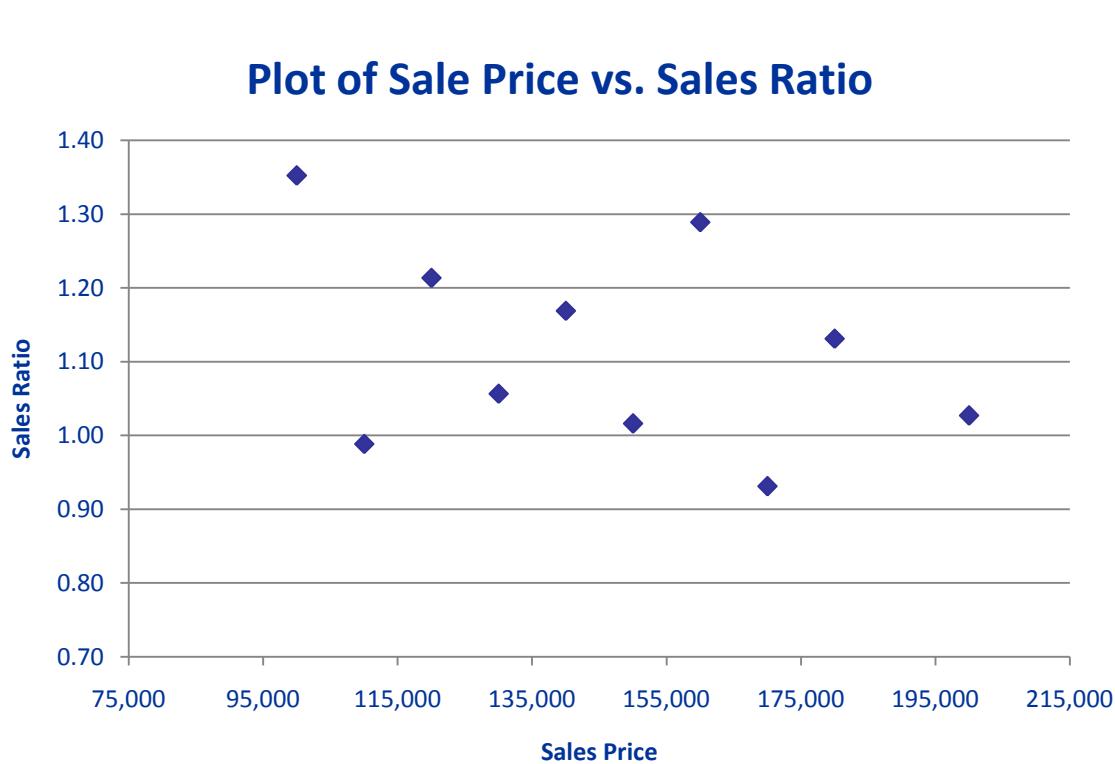
Plot of Sale Price vs. Sales Ratio

Sale Price	Ratio
100,000	1.35
110,000	0.99
120,000	1.21
130,000	1.06
140,000	1.17
150,000	1.02
160,000	1.29
170,000	0.93
180,000	1.13
190,000	0.70
200,000	1.03

Concept
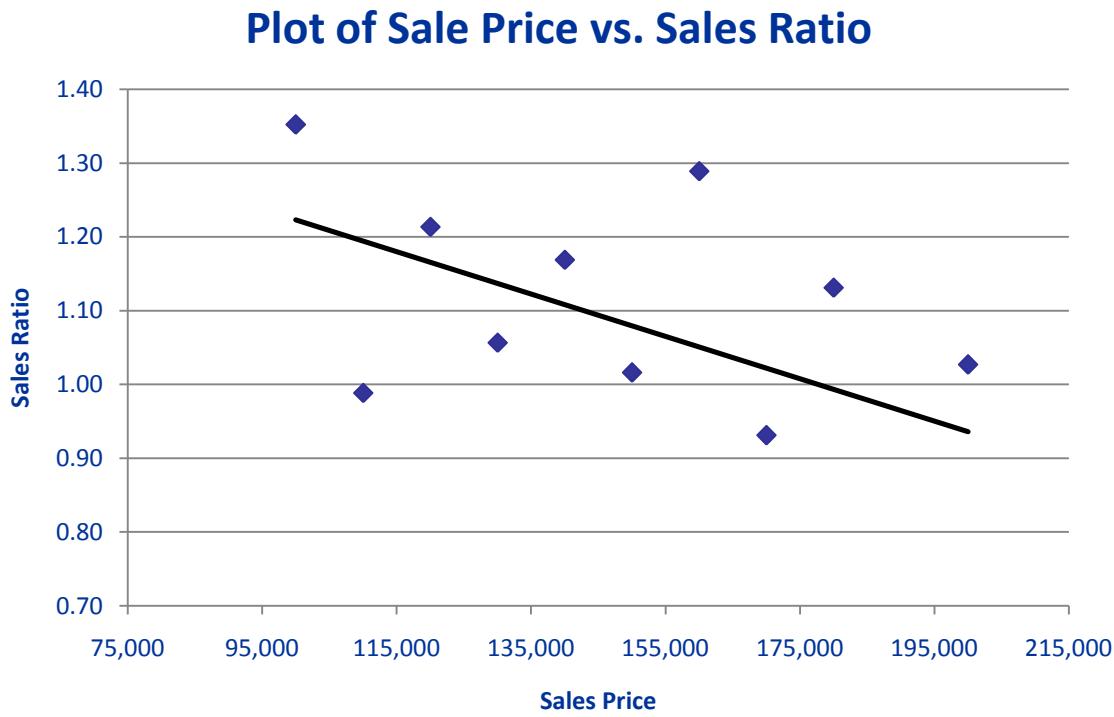
Plot of Sale Price vs. Sales Ratio

Sale Price	Ratio
100,000	1.35
110,000	0.99
120,000	1.21
130,000	1.06
140,000	1.17
150,000	1.02
160,000	1.29
170,000	0.93
180,000	1.13
190,000	0.70
200,000	1.03

Calculation

- Rank the Sales Prices from highest (1) to lowest (11).

Sale Price	Rank
100,000	11
110,000	10
120,000	9
130,000	8
140,000	7
150,000	6
160,000	5
170,000	4
180,000	3
190,000	2
200,000	1

Sale Price	Ratio
100,000	1.35
110,000	0.99
120,000	1.21
130,000	1.06
140,000	1.17
150,000	1.02
160,000	1.29
170,000	0.93
180,000	1.13
190,000	0.70
200,000	1.03

Calculation

- Next, rank the Ratios from highest (1) to lowest (11).

Sale Price	Rank	Ratio	Rank		Sale Price	Ratio
100,000	11	1.35	1		100,000	1.35
110,000	10	0.99	9		110,000	0.99
120,000	9	1.21	3		120,000	1.21
130,000	8	1.06	6		130,000	1.06
140,000	7	1.17	4		140,000	1.17
150,000	6	1.02	8		150,000	1.02
160,000	5	1.29	2		160,000	1.29
170,000	4	0.93	10		170,000	0.93
180,000	3	1.13	5		180,000	1.13
190,000	2	0.70	11		190,000	0.70
200,000	1	1.03	7		200,000	1.03

Calculation

- Net, subtract each Ratio Rank from its corresponding Sales Price Rank.

Sale Price	Rank	Ratio	Rank	Diff.		Sale Price	Ratio
100,000	11	1.35	1	10		100,000	1.35
110,000	10	0.99	9	1		110,000	0.99
120,000	9	1.21	3	6		120,000	1.21
130,000	8	1.06	6	2		130,000	1.06
140,000	7	1.17	4	3		140,000	1.17
150,000	6	1.02	8	2		150,000	1.02
160,000	5	1.29	2	3		160,000	1.29
170,000	4	0.93	10	-6		170,000	0.93
180,000	3	1.13	5	-2		180,000	1.13
190,000	2	0.70	11	-8		190,000	0.70
200,000	1	1.03	7	-6		200,000	1.03
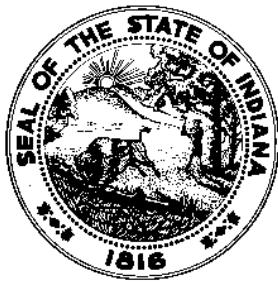
Calculation

- Square each of these differences.

Sale Price	Rank	Ratio	Rank	Diff.	Diff (Squared)	Sale Price	Ratio
100,000	11	1.35	1	10	100	100,000	1.35
110,000	10	0.99	9	1	1	110,000	0.99
120,000	9	1.21	3	6	36	120,000	1.21
130,000	8	1.06	6	2	4	130,000	1.06
140,000	7	1.17	4	3	9	140,000	1.17
150,000	6	1.02	8	2	4	150,000	1.02
160,000	5	1.29	2	3	9	160,000	1.29
170,000	4	0.93	10	-6	36	170,000	0.93
180,000	3	1.13	5	-2	4	180,000	1.13
190,000	2	0.70	11	-8	64	190,000	0.70
200,000	1	1.03	7	-6	36	200,000	1.03

Calculation

- Add them all up.

Sale Price	Rank	Ratio	Rank	Diff.	Diff (Squared)	Sale Price	Ratio
100,000	11	1.35	1	10	100	100,000	1.35
110,000	10	0.99	9	1	1	110,000	0.99
120,000	9	1.21	3	6	36	120,000	1.21
130,000	8	1.06	6	2	4	130,000	1.06
140,000	7	1.17	4	3	9	140,000	1.17
150,000	6	1.02	8	2	4	150,000	1.02
160,000	5	1.29	2	3	9	160,000	1.29
170,000	4	0.93	10	-6	36	170,000	0.93
180,000	3	1.13	5	-2	4	180,000	1.13
190,000	2	0.70	11	-8	64	190,000	0.70
200,000	1	1.03	7	-6	36	200,000	1.03

303

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6\frac{d}{n(n^2 - 1)}$$

d: 303
n: 11

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6 \frac{303}{n(n^2 - 1)}$$

d: 303

n: 11

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6\frac{303}{11(11^2 - 1)}$$

d: 303

n: 11

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6\frac{303}{1320}$$

d: 303

n: 11

$11(11^2 - 1)$

$11(121 - 1)$

$11(120)$

1320

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6(0.2295)$$

$$r = 1 - 1.3773$$

$$r = -0.3773$$

| d: 303 |
| n: 11 |

Calculation

- Now, plug the values for "r" and "n" into this formula.

$$t = r \sqrt{\frac{n-2}{1-r^2}}$$

d: 303
n: 11
r: -0.3773

Calculation

- Now, plug the values for "r" and "n" into this formula.

d:	303
n:	11
r:	-0.3773

$$t = -0.3773\sqrt{\frac{11-2}{1-(-0.3773)^2}}$$

Calculation

- Now, plug the values for "r" and "n" into this formula.

d:	303
n:	11
r:	-0.3773

$$t = -0.3773 \sqrt{\frac{8}{1-(-0.3773)^2}}$$

- Now, plug the values for "r" and "n" into this formula.

$$t = -0.3773\sqrt{\frac{8}{0.8576}}$$

| d: 303 |
| n: 11 |
| r: -0.3773 |

$$1 - (-0.3773)^2$$

$$1 - 0.1424$$

$$0.8576$$

Calculation

- Now, plug the values for "r" and "n" into this formula.

$$t = -0.3773\sqrt{9.3284}$$

$$t = -0.3773 * 3.0542$$

$$t = -1.1524$$

d: 303
n: 11
r: -0.3773

Calculation

- What exactly do the number "r" and "t" mean?
  - *r* is the *strength of correlation*
  - *r* is always between -1 and 1

d: 303
n: 11
r: -0.3773
t: -1.1524
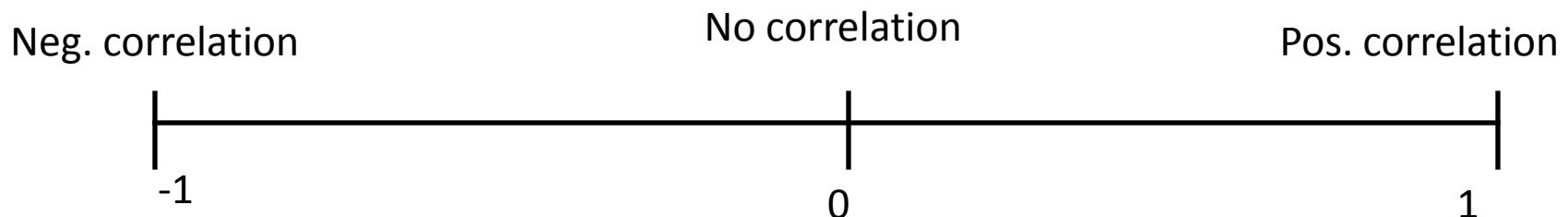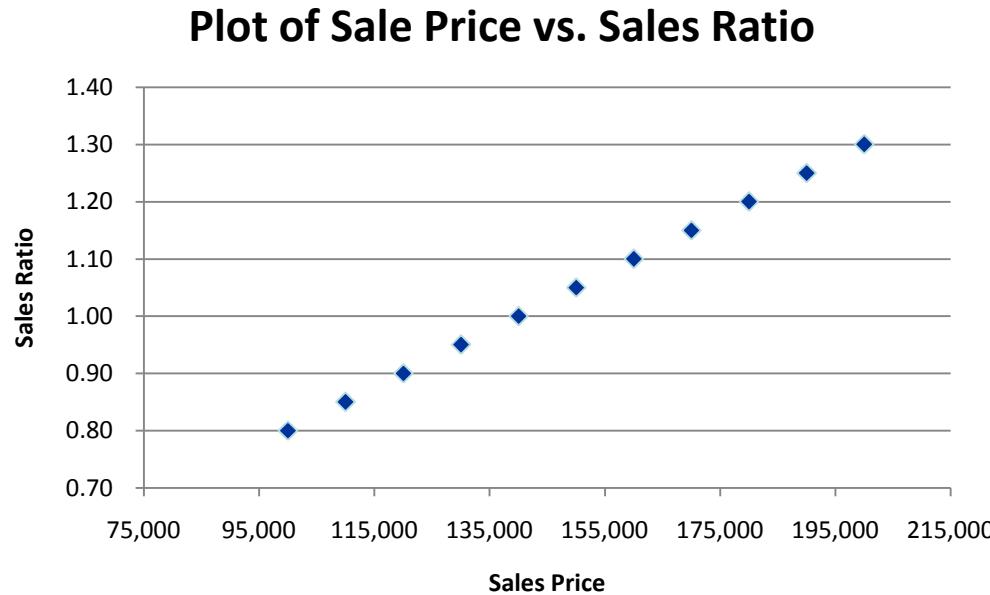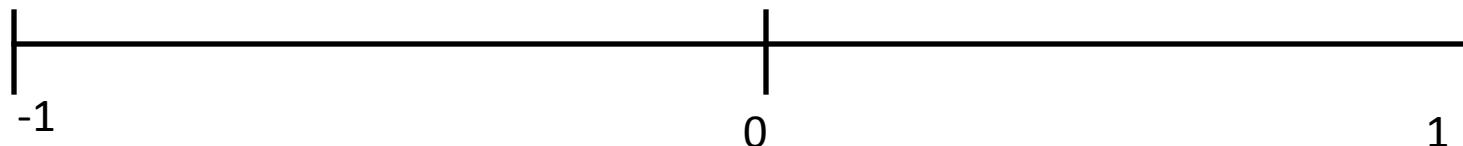
Neg. correlation

No correlation

Pos. correlation

|——————————|——————————|

-1

0

1

Calculation

Plot of Sale Price vs. Sales Ratio

r = 1

Neg. correlation

No correlation

Pos. correlation

-1

0

1

Calculation

Plot of Sale Price vs. Sales Ratio

r = -1

Neg. correlation   No correlation   Pos. correlation

-1   0   1

Calculation

Plot of Sale Price vs. Sales Ratio

r = 0

Neg. correlation   No correlation   Pos. correlation

-1   0   1

49

Calculation

Plot of Sale Price vs. Sales Ratio
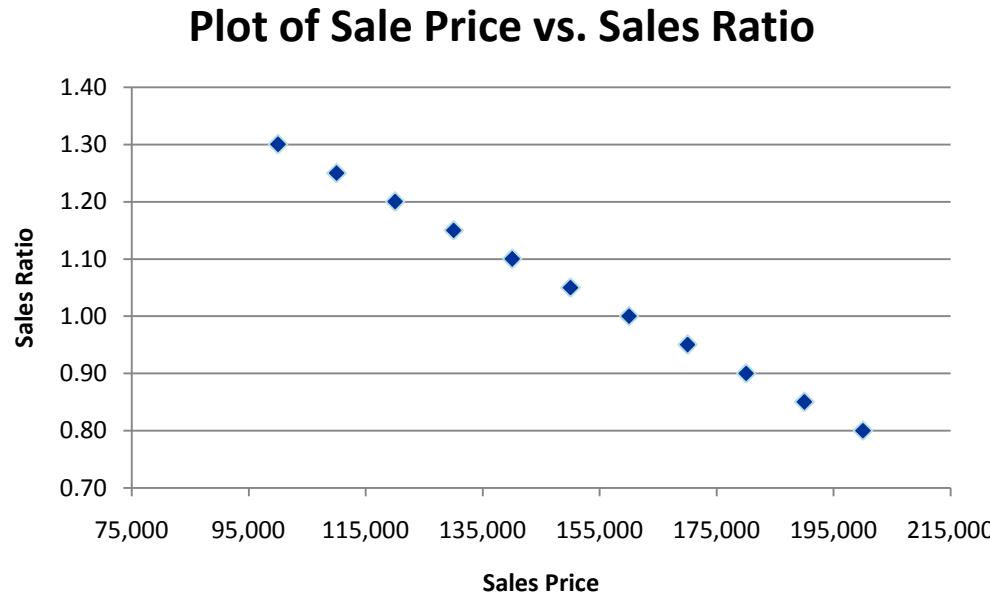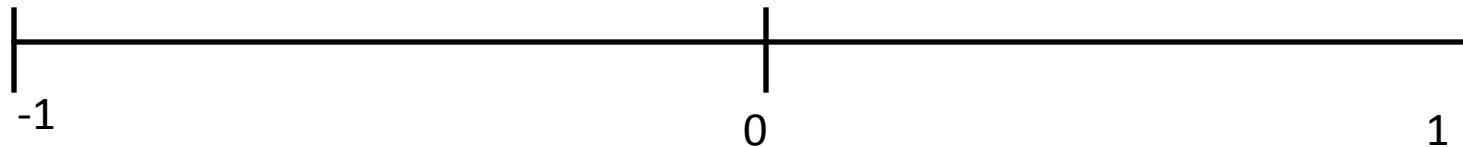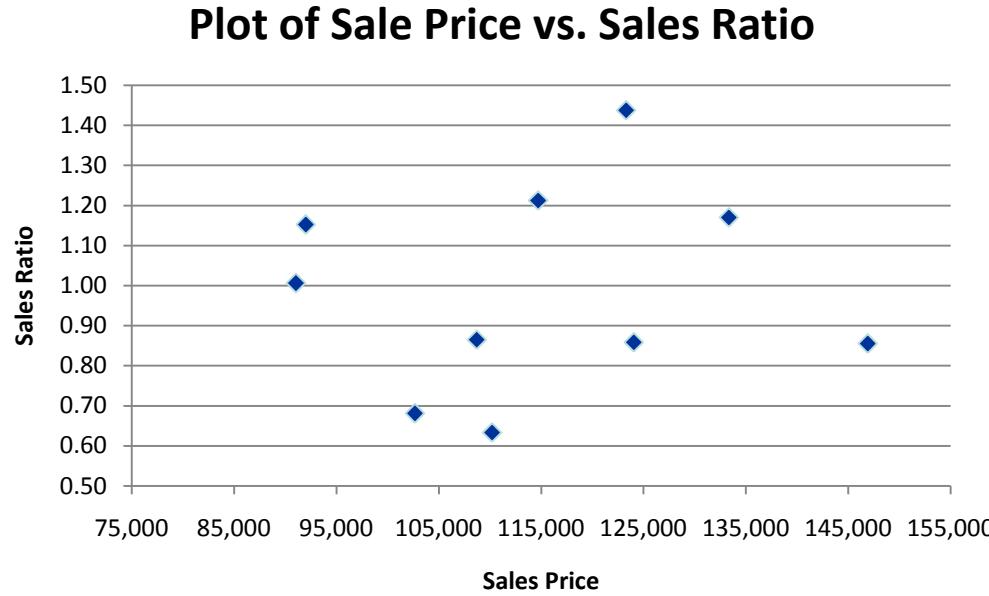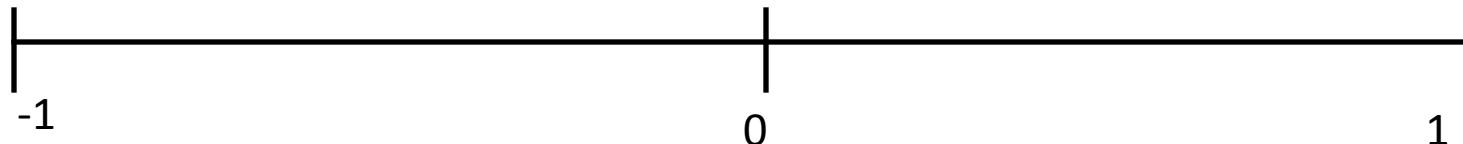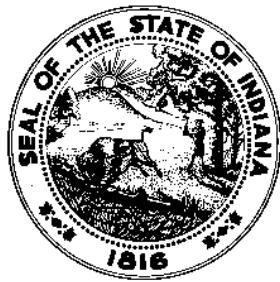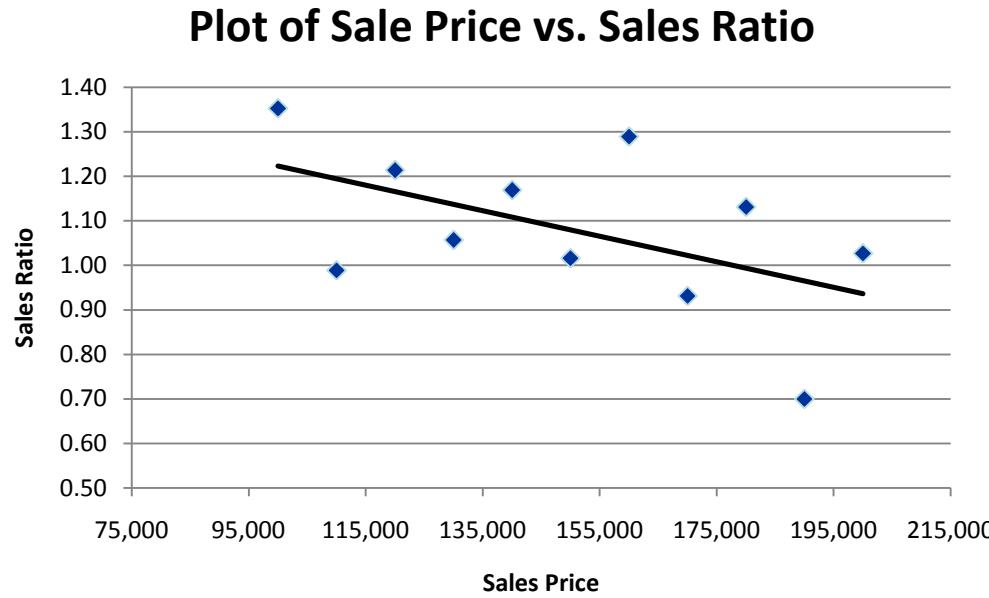
r = -0.3773

Neg. correlation   r   No correlation   Pos. correlation

-1   0   1

Calculation

STUDENT T DISTRIBUTION : f(X)

VALUE STOCHASTIC VARIABLE
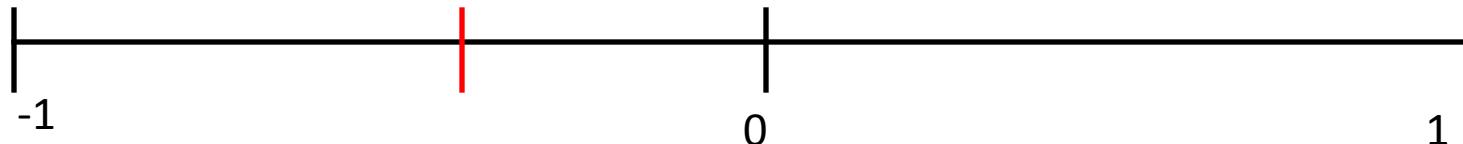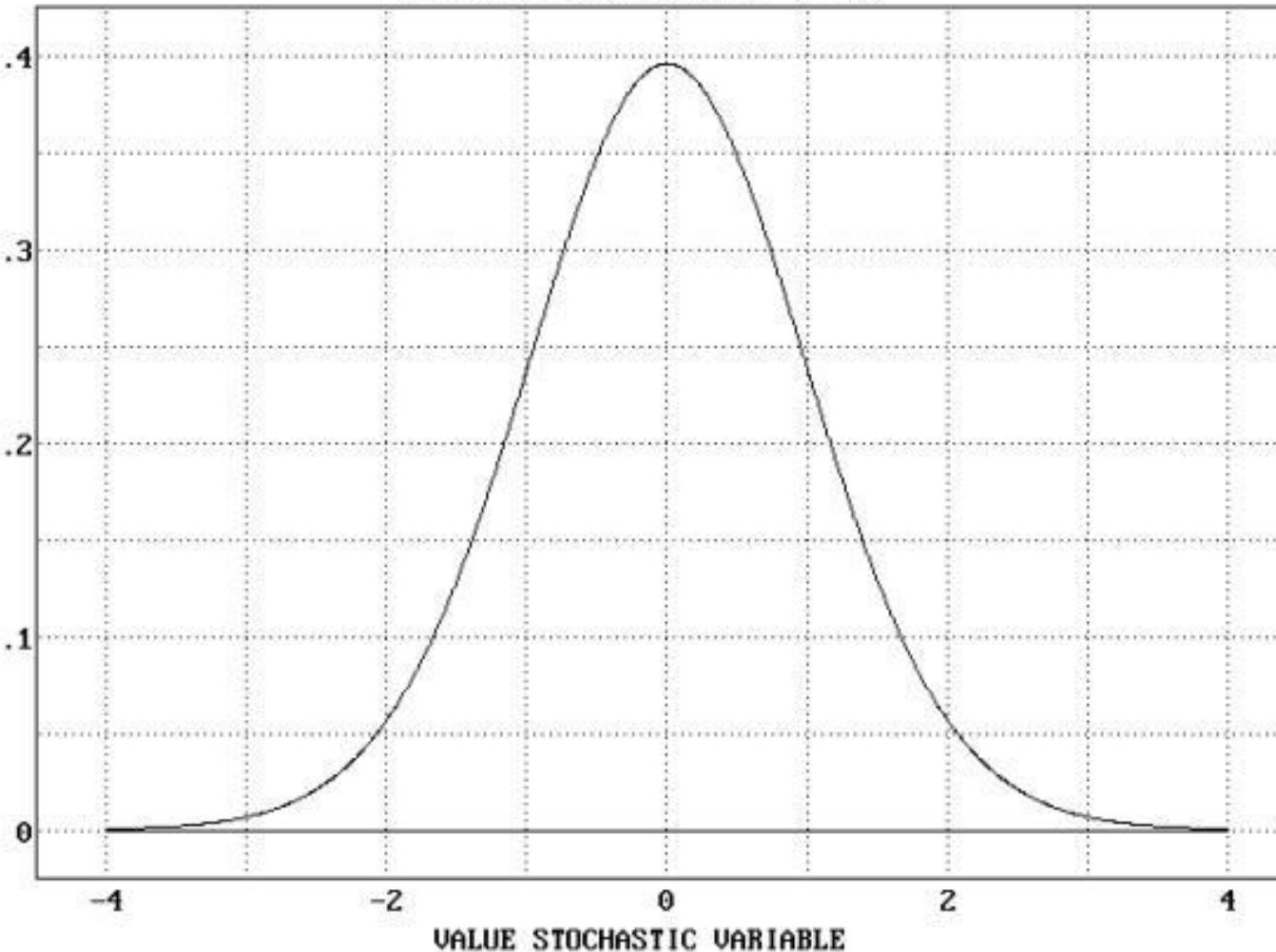
t-distribution

Calculation

STUDENT T DISTRIBUTION : f(X)

VALUE STOCHASTIC VARIABLE

t-distribution

t = -1.1524
p = 0.2788
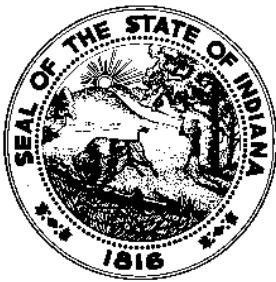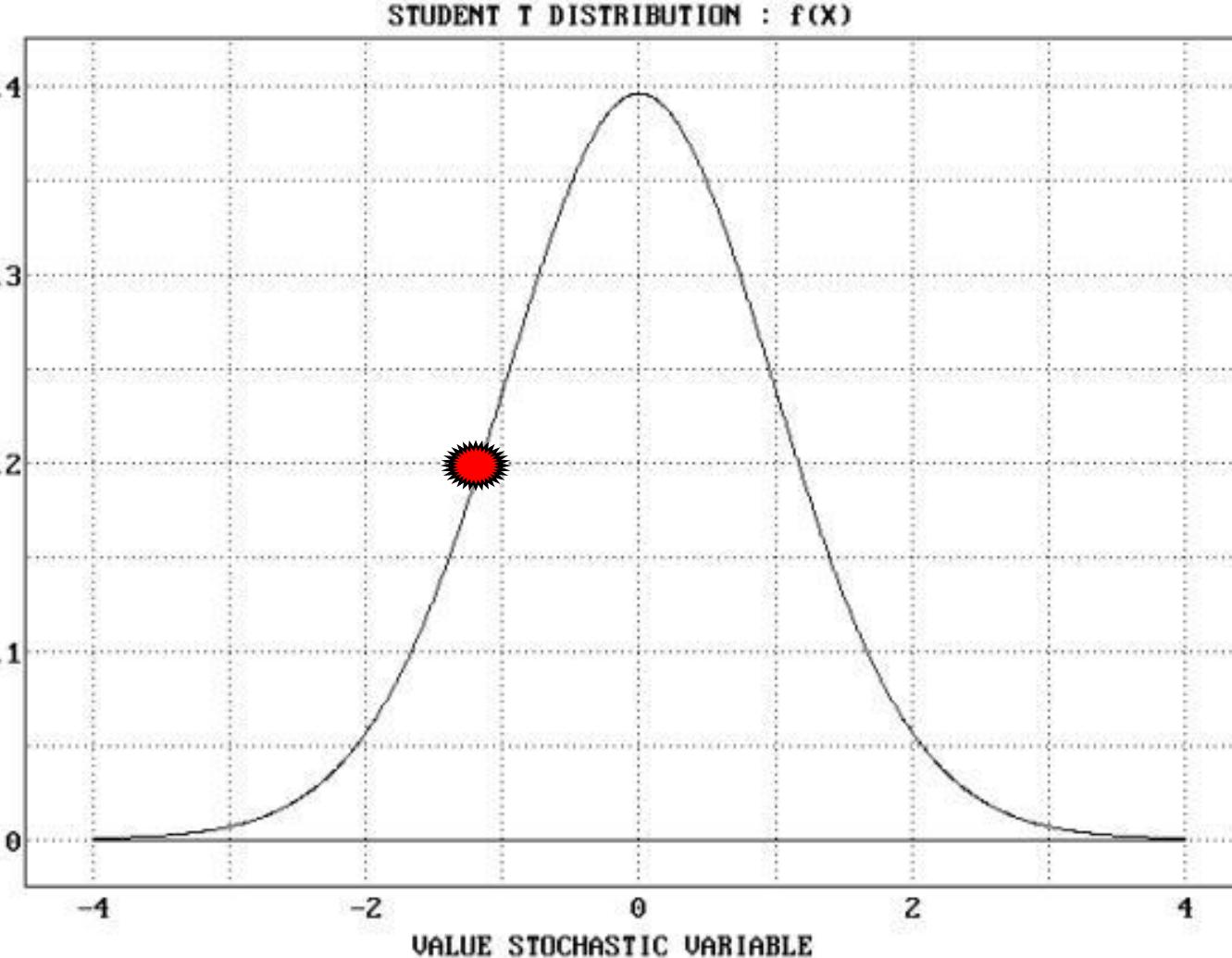
Worked Example

- You have assessed a group of six properties, and all statistics are fine except for the PRD, which is low. You have re-checked your data and believe the assessments are correct.

- How can you be sure there is no inequity?

Worked Example

Assessed Value	Sale Price	Ratio
35,000	56,000	0.63
34,100	33,200	1.03
91,000	86,400	1.05
119,800	129,800	0.92
136,600	101,200	1.35
174,500	145,300	1.20

Median: 1.04
COD: 16.5%
PRD: 0.96

Worked Example

- Find the difference between the ranks.

Sale Price	Rank	Ratio	Rank	Diff		Sale Price	Ratio
56,000	6	1.03	4	2		56,000	0.63
33,200	5	0.63	6	-1		33,200	1.03
86,400	4	1.05	3	1		86,400	1.05
129,800	3	0.92	5	-2		129,800	0.92
101,200	2	1.35	1	1		101,200	1.35
145,300	1	1.20	2	-1		145,300	1.20

Worked Example

- Square each of these differences.

Sale Price	Rank	Ratio	Rank	Diff	Diff Squared	Sale Price	Ratio
56,000	6	1.03	4	2	4	56,000	0.63
33,200	5	0.63	6	-1	1	33,200	1.03
86,400	4	1.05	3	1	1	86,400	1.05
129,800	3	0.92	5	-2	4	129,800	0.92
101,200	2	1.35	1	1	1	101,200	1.35
145,300	1	1.20	2	-1	1	145,300	1.20

Worked Example

- Add them all up.

Sale Price	Rank	Ratio	Rank	Diff	Diff Squared	Sale Price	Ratio
56,000	6	1.03	4	2	4	56,000	0.63
33,200	5	0.63	6	-1	1	33,200	1.03
86,400	4	1.05	3	1	1	86,400	1.05
129,800	3	0.92	5	-2	4	129,800	0.92
101,200	2	1.35	1	1	1	101,200	1.35
145,300	1	1.20	2	-1	1	145,300	1.20
					12		

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6\frac{d}{n(n^2 - 1)}$$

d: 20
n: 6

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6 \frac{20}{n(n^2 - 1)}$$

d: 20
n: 6

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6\frac{20}{6(6^2 - 1)}$$

d: 20

n: 6

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6 \frac{20}{210}$$

| d: 20 |
| n: 6 |

$6(6^2 - 1)$

$6(36 - 1)$

$6(35)$

210

Calculation

- Plug the values for "d" and "n" into this formula.

$$r = 1 - 6(.0952)$$

$$r = 1 - 0.5714$$

$$r = 0.4286$$

| d: 20 |
| n: 6 |

Calculation

- Now, plug the values for "r" and "n" into this formula.

$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

d:	20
n:	6
r:	0.4286

Calculation

- Now, plug the values for "r" and "n" into this formula.

d:	20
n:	6
r:	0.4286

$$t = 0.4286 \sqrt{\frac{6-2}{1-(0.4286)^2}}$$

- Now, plug the values for "r" and "n" into this formula.

d: 20
n: 6
r: 0.4286

$$t = 0.4286 \sqrt{\frac{4}{1 - (0.4286)^2}}$$
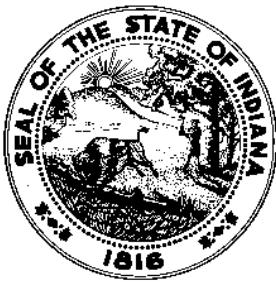
Calculation

- Now, plug the values for "r" and "n" into this formula.

$$t = 0.4286 \sqrt{\frac{4}{0.8163}}$$

| d: 20 |
| n: 6 |
| r: 0.4286 |

$$1 - (0.4286)^2$$

$$1 - 0.1837$$

$$0.8163$$

Calculation

- Now, plug the values for "r" and "n" into this formula.

$$t = 0.4268\sqrt{4.9}$$

$$t = 0.4268 * 2.2136$$

$$t = 0.9448$$

d: 20
n: 6
r: 0.4286

Calculation

Plot of Sale Price vs. Sales Ratio
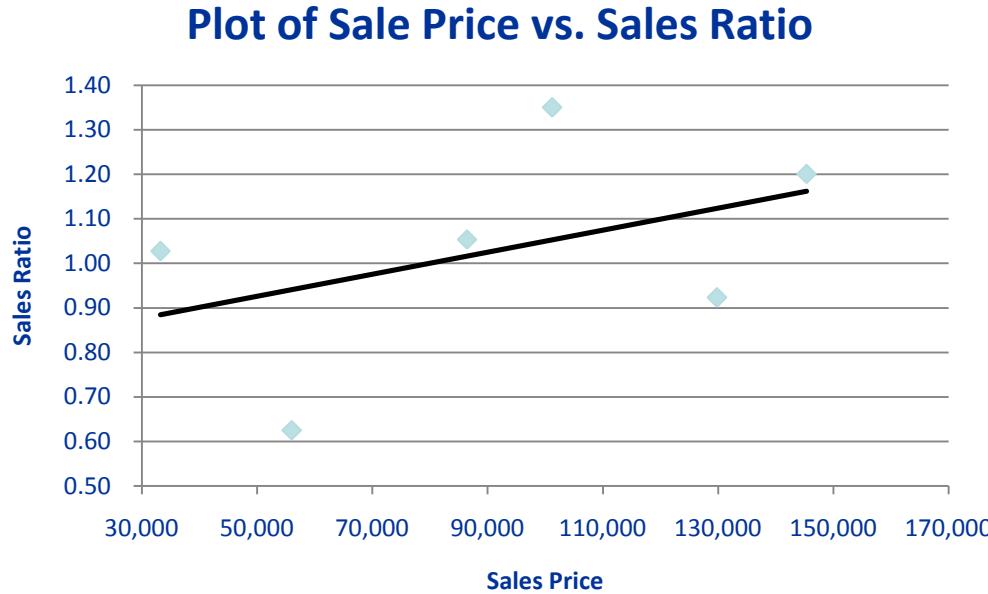

r = 0.4286

Neg. correlation   No correlation   r   Pos. correlation

-1   0   1

Calculation

STUDENT T DISTRIBUTION : f(X)

VALUE STOCHASTIC VARIABLE
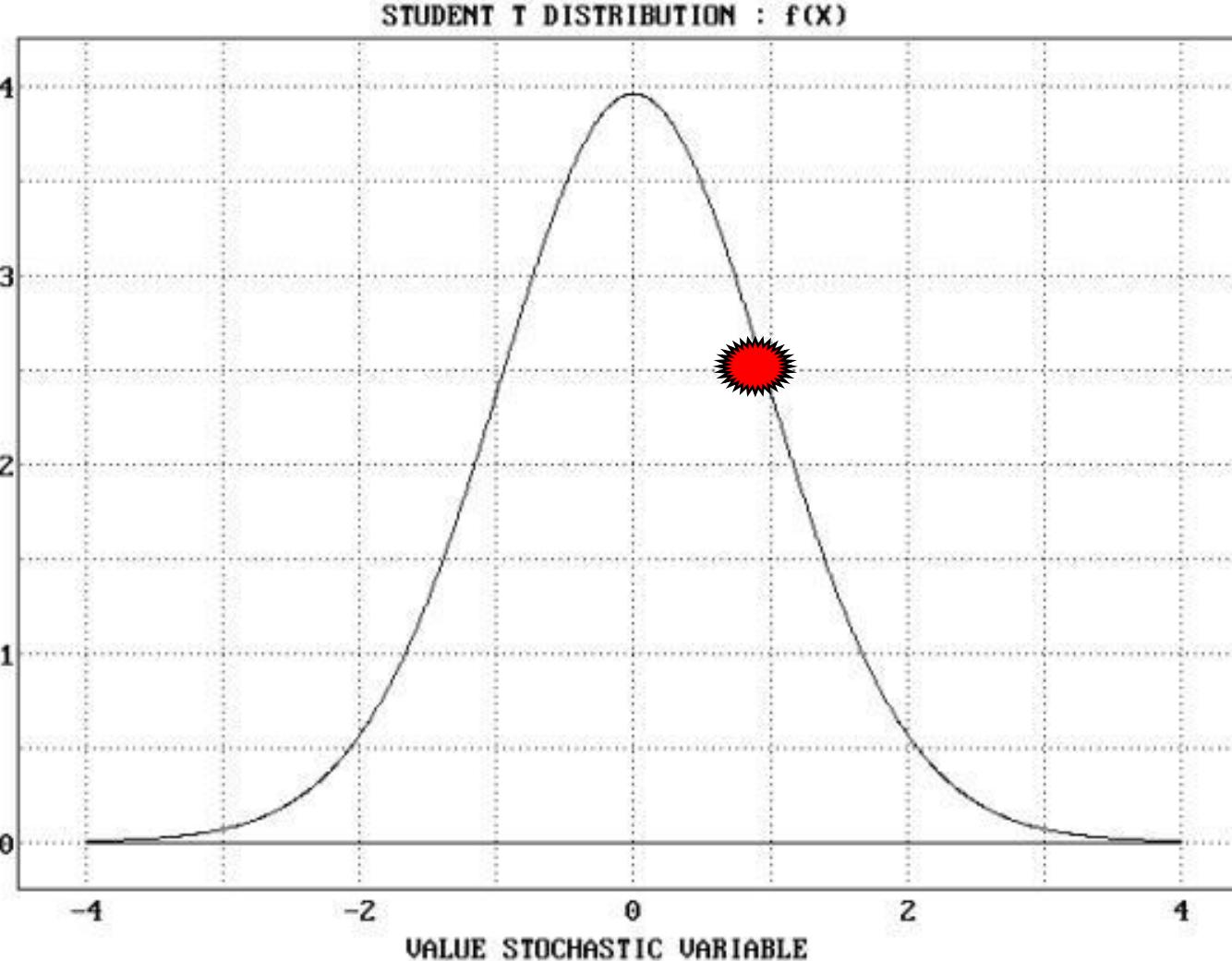
t-distribution:

t = 0.9448
p = 0.3965

Questions?

Contact the Department

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    - **Fax: 317.232.8779**
    - **E-mail: dschwab@dlgf.in.gov**
- **Web site: www.in.gov/dlgf**
    - **"Contact Us": www.in.gov/dlgf/2338.htm.**